THE AMERICAN OIL CHEMISTS' SOCIETY

JOURNAL OF OIL & FAT INDUSTRIES

Vol. II JULY, 1925 No. 3

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Journal of Oil and Fat Industries

Devoted to Oils, Fats and Allied Industries

VOL. II JULY, 1925 No. 3

EDITORIAL

PROGRESS

President's Message

By J. J. Vollertsen

Since its inception the American Oil Chemists' Society has been fortunate in having among its active members men who were willing, at great personal sacrifice, to devote considerable time to the advancement of the society's welfare. They were possessed of the spirit of pioneers and the willingness to labor in order to make their visions realities. Previous to its formation there existed numerous methods for the analysis of cottonseed products, which resulted in many disagreements in analyses. The standardization and adoption of methods for this class of work, assistance in formulating the rules of the Interstate Cottonseed Crushers' Association and the Smalley Foundation, which has increased the accuracy of the nitrogen and oil determinations to a remarkable degree, stand as testimonials to the fact that their work was well done. Their example is our heritage and incentive to carry on the work so well begun.

Unfortunately, all of our members cannot attend the meetings of the society, and thus obtain the inspiration which comes from listening to the reports and papers which are delivered, and from the personal contact with their fellow chemists. Likewise we cannot all serve on the committees which are selected by the President, with the advice of the respective chairmen. This, however, should not deter any member from giving some thought to the work of the society, and offering his suggestions and cooperation to the committees which are working on problems in which he is especially interested. In his daily work he may encounter conditions which have a pertinent bearing on the work of some committee, and by reporting it to the chairman he would greatly aid the progress of the work. With such coöperation the work of the committees would be simplified and made more effective.

Last year witnessed the formation of several new committees. The Planning Committee began a little late, but made themselves felt in the work of some of the committees by their suggestions. For several years the officers of the society have tried to expand its interest in fields other than those concerned entirely with cottonseed oil and its related branches. Their success is evidenced in the appointment of a Committee on the Analysis of Commercial Fats and Oils, and a Detergents Committee, and the adoption of methods for the analyses of fats, oils, and soaps. It is hoped that the coming year will see these methods published in a concise loose-leaf form, that will be available to all who have need of them.

We have all had sufficient experience to realize the truth of the statement that the returns we obtain from any activity are dependent entirely upon our interest in it, and the energy expended. This applies just as surely to the societies of which we are members as to our daily endeavors. The American Oil Chemists' Society is a growing body, and the rapidity and scope of its growth is entirely dependent upon the efforts of its officers and individual members. Those who have once been active in its work need no urging to continue. Those who have not been so fortunate, we would urge to take an active interest at once, for the mutual good which would result. Progress will be hastened by suggestions and constructive criticism. Give something to your society and thereby benefit yourself.

A. O. C. S. Committees for 1925–1926

GOVERNING COMMITTEE:
J. J. Vollertsen, *Chairman*
R. H. Fash, Thos. B. Caldwell, A. W. Putland, H. J. Morrison, L. M. Tolman, Dr. H. B. Battle, C. B. Cluff.

REFEREE BOARD:
Dr. David Wesson, *Chairman*
C. B. Cluff, N. C. Hamner, Archibald Campbell, J. J. Vollertsen.

Committees as Appointed by J. J. Vollertsen, Pres.

MEMBERSHIP COMMITTEE:
Mr. R. H. Fash, *Chairman*
P. W. Tompkins, W. H. Irwin, L. F. Hoyt, Thos. B. Caldwell, J. C. P. Helm.

PLANNING COMMITTEE:
Dr. David Wesson, *Chairman*
R. H. Fash, I. F. Laucks, H. J. Morrison, J. J. Vollertsen.

UNIFORM METHODS COMMITTEE:
F. B. Porter, *Chairman.*

AMMONIA COMMITTEE AND SMALLEY FOUNDATION:
H. C. Moore, *Chairman*
Dr. H. B. Battle, C. A. Butt, L. B. Forbes, W. J. Gascoyne, Jr.

BASIC RESEARCH COMMITTEE:
E. R. Barrow, *Chairman*
Dr. David Wesson, L. M. Tolman, H. J. Morrison, P. S. Tilson.

OIL CHARACTERISTICS COMMITTEE:
Dr. George S. Jamieson, *Chairman*
H. P. Trevithick, W. H. Irwin, I. W. Bosart, Glenn H. Pickard.

REFINING COMMITTEE:
C. B. Cluff, *Chairman*
H. P. Trevithick, E. R. Barrow, R. H. Fash, W. D. Hutchins.

SPENT FULLER'S EARTH COMMITTEE:
Peter P. Hindelang, *Chairman*
P. S. Tilson, G. W. Agee, Dr. H. B. Battle, H. A. Nester.

STANDARDIZATION OF LOVIBOND COLORIMETER:
H. P. Trevithick, *Chairman*
A. W. Putland, J. D. Evans, E. R. Barrow, E. M. James.

COMMITTEE ON THE ANALYSIS OF COMMERCIAL FATS AND OILS:
W. D. Richardson, *Chairman*
W. H. Irwin, *Secretary*, Paul Rudnick, J. J. Vollertsen, J. R. Powell, L. M. Tolman, R. W. Bailey, H. J. Morrison, H. P. Trevithick, T. C. Law, C. P. Long.

DETERGENTS COMMITTEE:
Archibald Campbell, *Chairman*
R. K. Brodie, C. P. Long, Percy H. Walker, J. R. Powell, R. E. Divine, H. P. Vermilya, W. J. Reese, H. S. Mitchell, E. T. Marceau, Dr. Martin H. Ittner, Dr. Jacob S. Goldbaum, Walter S. Rapelje, A. K. Church, F. W. Smither, L. F. Hoyt, H. C. Bennett.

SUB-COMMITTEE ON THE DETERMINATION OF THE DETERGENCY OF SOAP PRODUCTS:
L. F. Hoyt, *Chairman.*

SEED COMMITTEE:
D. C. Picard, *Chairman.*

MOISTURE COMMITTEE:
P. S. Tilson, *Chairman*
E. C. Ainslie, W. H. Irwin, J. P. Long, R. C. Hatter.

CHICAGO, ILLINOIS, June, 1925.

PROCEEDINGS OF THE SIXTEENTH ANNUAL CONVENTION

PRESIDENT'S MESSAGE

By H. J. Morrison

The Journal.—Our JOURNAL is one year old. The Society is to be congratulated for the successful launching of this cherished dream. It is with considerable wonder that it survived at all. If it had not been for the self-sacrificing enthusiasm of our Editor, H. S. Bailey, it would not have passed its first quarter. Shortly after launching the first number business reverses of the corporation with which Mr. Bailey was connected forced the closing of his laboratory and dispersal of his organization. He entered a new field of endeavor quite different from his former interest and environments. With the load of organizing, planning, and installing much of a new plant in a new line with which he was not familiar, he still carried on for this Society the work he had undertaken. For a lesson in loyalty to a cause and his fellows, I point to Mr. H. S. Bailey. This society owes a debt of gratitude to him which cannot be paid in full. The balance, I am sure, will be funded in the hearts of his fellow members and will pay dividends to him as opportunities occur.

Any one familiar with the formation of organizations knows how easy it is to draw a pretty picture of a smooth running machine on paper, but the rub comes in filling the positions in this picture with proper persons. We had an easy problem in the start of our journalistic career. We are now faced with difficulties. These have been lightened by Mr. Bailey consenting to carry on for a further time. It is quite evident, however, that with his interests now quite foreign to the subjects dealt with in our periodical, it will be an imposition to ask him to continue in active charge longer than necessary to find a solution.

Membership.—Due to continued business troubles, retrenchments and reorganizations in lines to which many of our members belonged, we lost many. This condition threw a great burden upon our Membership Committee to take up this large deficit. It has, however, been accomplished as the report of the Chairman of this committee will show.

The horizon now seems clear and it is our hope that the way is opened for enlarging the membership very materially this coming year.

The F. A. C. and Detergents Committee.—A step forward, I believe, has been made in the broadening of our activities, which has been our aim for several years past by the addition of these two committees.

The Chairman of the Committee on the Sampling and Analysis of Commercial Fats and Oils of The American Chemical Society, better known as the F. A. C., at a meeting in Chicago brought up the subject

of serving in the same capacity for The American Oil Chemists' Society. After full discussion, the main argument of which was the obvious desirability of concentration and singleness of endeavor, avoiding duplication of work and possible differences or non-uniformity of methods, which would undoubtedly occur with two committees of differing personnel. Other advantages of such an arrangement were and are obvious, but I will not take time here to discuss these. The F. A. C. were with one exception members of this Society, and the exception does not now exist. The committee has also been enlarged by adding some members who have been most active in the affairs of this Society, further amalgamating and strengthening the committee.

The Detergents Committee had for its foundation the Committee on the Sampling and Analysis of Soaps and Allied Products of The American Chemical Society. To this committee have been added a number of associate members with full powers who are not all members of this Society. These associate members represent interests whose consent to methods, specifications, etc., it is necessary to obtain, and whose views from the buying and commercial angle are invaluable.

With these committees now fully under way it is the hope that we can arouse the interest of all our brother chemists and technologists by the various lines of oil and fat technology to give us their active support and assistance.

I am quite sure we have and will have in our endeavors for closer cooperation in these industries the hearty support of men of broad views and especially of many editors of technical journals. I wish here to express to these my thanks for their coöperation this past year.

Referee Chemists.—Experience makes perfect. Our committee is having new experiences continuously and, in consequence, finds it necessary to modify and tighten up its rules on the issuance of certificates. The object is not to exclude any one worthy but to mark those who do obtain a certificate from this Society as an expert and worthy of the full confidence of the public, with the endorsement of this Society collectively and individually without reservation back of them. On the other hand, they must appreciate their responsibility to this Society and their profession, which I think is not a light one.

The Constitution and By-Laws.—At the appropriate time you will be asked to pass on some changes in our Constitution and By-Laws.

When drawing our constitution we were assured that meetings held outside the State of Louisiana would have the same force and effect as a meeting within this state. This was later found to be not the case. A curative act, known as Act 190, approved July, 1924, has been passed allowing societies such as ours to hold meetings and transact business outside the state with the same force and effect as within the state. An article should, therefore, be

added to our constitution taking advantage of this broader liberty of action. A resolution prepared by our attorneys has been mailed to all members.

The By-Laws likewise need revision. These proposed changes were printed in the April number of our JOURNAL. The necessity of these changes is to conform to certain regulations of the Post Office Department, making clear that all members are bona-fide subscribers to our official JOURNAL. This change will give us the privilege of the lowest classification. This will also be retroactive as a rebate will be allowed our Publishing Department on the number already sent out for which bond has been posted.

Publication of Methods.—If methods as a whole are not printed frequently and in a convenient form, amendments and additions become scattered through several volumes. Often these volumes are not of the handiest size.

In the past and so far as we know in the future, we have been fortunate in having our rules as applied to cottonseed products printed for us at a cost of fifty cents per volume to non-members of the Interstate Cotton Seed Crushers' Association. These rules do not present a problem. The F. A. C. and Detergents Committee Methods, however, do.

A scheme to overcome this has been proposed which will not entail any expense to the Society. It is a loose leaf compilation which, of course, can always be kept up to date in a single and compact form. The advantages of such a publication are not confined to its convenience only. Its distribution to others will add, I believe, to our prestige and give desired publicity to our name and methods. Regarding the latter, I might observe in passing it is one thing to get up uniform methods, and another to have these methods not only recognized as official but used in all their details, and only by having these methods up to date and in a convenient form can we hope to have details followed.

In conclusion. I shall always look back upon my year tenure of office with the greatest pleasure. I have not made a request of a single member which has not been cheerfully acceded to. To one and all, I extend my heartiest thanks for your cordial coöperation. The honor of having presided over the destinies of The American Oil Chemists' Society is in itself a source of great pride. For enabling me to attain this honor, I am also grateful to all of you. My one anxiety has been my inability to have accomplished more for the Society.

I know the Society is on firm ground and is on the road to accomplish more and to spread its influence to other lines which have not had the benefit of a well organized and experienced association with the high ideals whose members one and all have helped for the common good and submerged personal interests.

THE PROCTER & GAMBLE CO.
IVORYDALE, OHIO

REPORT ON THE PRESIDENT'S MESSAGE

Referee Chemists

We wish to emphasize the importance of checking the work being done regularly in the Referee Chemists' Laboratories in addition to the co-operative work of the Smalley Foundation as indicated in the Report of the Referee Board.

Constitution and By-Laws

We heartily recommend to our Society the proposed changes in our Charter and By-Laws.

Publication of Methods

We approve very heartily the scheme advanced by our President that will enable us to have our Official Methods printed in loose leaf form.

TILSON, *Chairman*, CLUFF AND PAQUIN

MANAGING EDITOR'S REPORT

BY FRED. H. SMITH

On Advertising Business, Journal Oil and Fat Industries, Volume I, 1924. July and October Issues

Part I. Regarding the Financial Report—time nor funds used in getting the *Journal of Oil and Fat Industries* started are by no means fully shown on the sheet. On the other hand, the difficulties incident to establishing a new journal's advertising clientele caused expense to be high and the work unusually demanding. The Editor mentioned in the April JOURNAL the difficulty in securing suitable contributions of papers. Securing advertising, for a scientific journal particularly, also uncovers some unsuspected knots. Approximately 285 concerns or individuals involved in the selling side of oil and fat industries have been repeatedly approached, yet only 26 paying advertisers were secured in 1924. And one of these cost us the exchange of more than a dozen letters before the "capitulation." Others stood the shock better and haven't succumbed yet, under even heavier attacks. Advertising has been exchanged with the *American Journal of Botany*.

During the early months it was necessary to "feel out" in determining the appropriate rate card. Unfortunately, in the issues of those earlier months a rather heterogeneous scale-of-charge exists, though this will be almost entirely corrected with the July, 1925, issue, and following. Publishers insist that rates be increased. We hate to do this, in consideration of our loyal original advertisers who show promise of staying with us under

present conditions and who have become accustomed to existing rates, and too, since the circulation hardly warrants increase, and for other reasons. And, too, the profits are more than was anticipated at the beginning.

There are yet in our territory a few firms who should by all means carry ads in the JOURNAL, but even with the kindly help of others of this Body, we have not been able to land them, and after repeated attempts. From an original list of about 285 prospects it appears now that there are only about 60 establishments we can consider as possibly desirable advertisers for publications of the JOURNAL'S limitations. And right there we see need of HELP FROM those MEMBERS who purchase equipment or supplies. It need not appear "plebian" to our chemical dignity if we add a line to the order "..... saw your ad in *Oil & Fat Industries*....." Such lines help keep advertisers and a similar remark to a favorite dealer who possibly hasn't come into the fold, may bring results. And the result is important—that is, if added revenue to the A. O. C. S. means anything. BUT THE PURPOSE IN BUILDING UP THE AD SECTION IS NEVER ALTOGETHER A MATTER OF REVENUES. A live, interesting illustrated advertisement is always informative. The advertisers, generally, are our friends and if possible they should be treated as civil service treats veterans—give them 5 per cent advantage when buying in their line. Some of our chemist friends in this field, too, have not used space in the directory section, but we have not been particularly persistent after them, preferring to wait for the Quaker in their spirit.

Basing the observation on the advertising already in sight or contracted for we predict that net revenue for 1925, Volume II, will outshadow proportionately those 1924 figures covering a period when the infant, 6-months old at the close of 1924, hadn't begun to "take notice" or hadn't been extensively advertised to the outer world, to say nothing of "sitting alone."

A number of new members have been obtained through efforts of this Department and may be credited directly to the JOURNAL.

Management of Circulation and of Advertising business, we think, should be more closely connected. Perhaps the Managing Editor should be required to handle collections and circularize for the non-membership subscriptions, leaving the Secretary as at present only with the burden of membership subscriptions. With the present arrangement in advertising revenues no extra remuneration, beyond the expenses of handling the work should be made if the advertising and circulation work should be combined. I respectfully recommend this matter for action by the President's Governing Committee. Heretofore, remittances for subscriptions have been turned over to the Treasurer as received, for credit and for adding to mailing lists. All matters of collections for subscriptions originating through effort of this office have been handled here.

As to the future of the advertising section we can hardly expect, nor do we think it advisable to compete with trade papers in bulk of advertising. It is doubtful if we should try, or even if it would be possible, to expand beyond a 20-page advertising section. This number of pages is sufficient to make the book attractive. The handicap in lining up advertising is our circulation, and it is for this reason that we believe the two activities should be allied. The page-profits at the obtaining low rates are governed to a considerable extent according to whether the ad is new copy, re-run, revision, and so forth. We might say that the limit of expected advertising in a 20-page section and at present maximum rates is around $300 revenue, total per issue, and this can hardly be obtained within the life of Volume II, since the field of prospects has been rather well covered, and since many of these prospects budget their advertising about December. All known prospects are regularly solicited by direct individual correspondence and through the multigraph.

We are moved here to make hearty acknowledgment of the friendly advices, criticisms, encouragement, and help, of Editor Bailey and of the Publishers. Without the advice of the former along suggestive and critical lines and the help from the latter in maintaining liaison with our advertisers this job would have been far more difficult and demanding, with fewer pleasant features. We commend to your appreciative attention the quality of printing obtained in the advertising section of the JOURNAL.

MANAGING EDITOR'S ADVERTISING REVENUE REPORT, PART II, FOR VOL. I, 1924

Income from advertising, July, 1924, issue		$288.35
Ditto, October, 1924		264.70
Printing Costs July: Distribution of Payments—J. W. Murray check, $20; H. B. B. check, $3	$ 23.00	
Managing Editor's check	67.00	
Charge for "dummies," July, 1924	5.34	
Printing costs, October, 1924, issue, ads	70.04	
Printing costs, July issue, steno., stationery, printing, postage, express	46.23	
Ditto, October, 1924, issue	47.50	
Telegrams, multigraph, and general expenses September 15, 1924, to January 1, 1925	27.30	
	$286.41	$553.05
Balance		$266.64

To Treasurer from Managing Editor, account 50% net earnings of July and October, 1924, issues (F. H. S. check, 4/30/25) $133.32

GEORGIA STATE EXPERIMENT STATION
EXPERIMENT, GEORGIA

REFEREE BOARD'S REPORT

By David Wesson, *Chairman*

During the year just passed the board has consisted of: H. J. Morrison, Archibald Campbell, C. B. Cluff, N. C. Hamner, with David Wesson, *Chairman*.

The list of laboratories and chemists who have been certified during the year is as follows:

Referee Chemists of the American Oil Chemists' Society for Year 1924–1925

The following have been certified on all products dealt in under the rules of the Interstate Cotton Seed Crushers' Association:

Barrow-Agee Laboratories, Memphis, Tenn.; The Battle Laboratory, Montgomery, Ala.; Chemical and Engineering Company, Chicago, Ill.; Curtis and Tompkins, San Francisco, Cal.; Falkenburg and Company, Seattle, Wash.; Fort Worth Laboratories, Fort Worth, Texas; J. C. P. Helm, New Orleans, La.; P. S. Tilson, Houston, Texas; Lehman Johnson, Memphis, Tenn.; Law and Company, Atlanta, Ga.; Landon C. Moore, Dallas, Texas; J. C. Patrick, Jefferson City, Mo.; Felix Paquin, Galveston, Texas; D. C. Picard, Birmingham, Ala.; Southwestern Laboratories, Dallas, Texas; H. P. Trevithick, New York, N. Y.; A. C. Sutherland, Columbia, S. C.; Edward G. Williams, New Orleans, La.; H. G. Huffman, Los Angeles, Cal.; Charles W. Rice and Company, Columbia, S. C.

The following have been certified on subjects enumerated:

R. M. Chapman (Cottonseed Meal and Cake), Hammond, Ind.; Gascoyne and Co., Inc. (Cottonseed Meal), Baltimore, Md.; I. F. Laucks (Oriental and Fish Oils), Seattle, Wash.; McCandless Laboratory (Cottonseed Meal), Atlanta, Ga.; Stillwell Laboratories (Cottonseed Meal and Soap Stock), New York, N. Y.; Wiley and Company (Cottonseed Meal), Baltimore, Md.; J. W. Sample (Cottonseed, cottonseed meal, fertilizers and feedstuffs), Nashville, Tenn.; Herbert M. Hill (Cottonseed Meal), Buffalo, N. Y.; Norfolk Testing Laboratories (Cottonseed Meal), Norfolk, Va.

The plan of having certification changed from the fall to the spring or early summer, proved very excellent in practice and cut out a large amount of detail work.

The experience of the board during the past year has demonstrated, that in addition to the present rules for certification, we must have still greater safeguards, and the board has unanimously agreed to the following additional ones and new form of application blank.

Proposed Regulations for the Licensing and Certification of Referee Chemists

1. Applications for certification must be filed with the Referee Board

not later than March 1st in any year for certificates covering the next season's work.

2. A list of applicants for certification will be published in the April number of the *Cotton Oil Press* with a request that any objections to any applicant shall be furnished the Referee Board in confidence, together with all facts on which said objections shall be based.

3. Certificates shall be issued as of June 1st of each year.

4. No certificate shall be issued to any applicant who does not agree to analyze all samples sent out by the Smalley Foundations and such other samples as the Examining Board may see fit to send out, and to furnish duplicate reports on such samples to the Referee Examining Board.

5. No certificate shall be issued except with the understanding that it may be revoked by the Board at any time for cause.

6. Where laboratories are operated by a firm or company, the certificate will be issued to the firm or company. In the case of single individuals operating laboratories, certificate will be issued to them as such. The fee for certification shall be, in the case of firms, or companies, Five Dollars ($5.00) per year; in the case of individuals, Two Dollars ($2.00) per year.

7. Certificates shall be issued only for such products as are covered by the rules of the Interstate Cotton Seed Crushers' Association, and may be for all the products or only such ones as the Referee Examining Board shall consider the applicant entitled to.

8. All referee chemists will be held strictly responsible for results appearing over their signatures. The dereliction of others will not be accepted as an extenuating circumstance.

All rulings of the Referee Examining Board shall be final.

Firms or laboratories starting business after March 1st of any year shall be permitted to apply for Certification at any time during the year.

Application for Certificate to the Referee Examining Board of the American Oil Chemists' Society

Application for certification is hereby made by———————————— to act as Referee Chemist for the year June 1, 1924, to May 31, 1925, on products dealt in under the rules of the Interstate Cotton Seed Crushers' Association, as follows:

1. All products.
2. Special products, *viz:*

In accepting this certification it is understood that the obligation is incurred of turning out accurate work, and for this reason the laboratory will take part in the coöperative work of the Smalley Foundation and such other coöperative work of the American Oil Chemists' Society or such other

samples as the Board may prescribe, sending duplicate reports on all such samples to the Referee Board.

It is further agreed that in analyzing referee samples only the official methods of the American Oil Chemists' Society and Interstate Cotton Seed Crushers' Association are to be employed.

It is agreed that all the regulations of the Referee Board shall be considered as part of this application.

——————————————————————————————Laboratory is a member in good standing of the American Oil Chemists' Society and the Interstate Cotton Seed Crushers' Association.

. . . . . .

Recommendations

As all applications for certification have to be first passed upon by the Secretary of the Society, it is believed that the clerical work of furnishing blanks to applicants and receiving same should be handled through the Secretary's office.

The secretary should then submit the properly endorsed applications showing that all fees have been paid and applicants are in good standing, to the Chairman of the Board who will have them passed on by the board in the usual manner, after which the Secretary shall make out the usual certificates.

When the referee board was first formed, it was voted by the Society, that it consist of five members with one retiring and a new one being elected each year, also that the President of the Society be a member ex-officio. It would, therefore, seem well to establish the custom of allowing the retiring President to continue to serve on the board and letting the member who has served five years drop out. This would in time, or in fact it has practically at present, make the board consist of ex-presidents.

SOUTHERN COTTON OIL CO.
120 BROADWAY, N. Y. C.

GOVERNING COMMITTEE REPORT

BY H. J. MORRISON

Your Governing Committee begs leave to report as follows:

Changes in Constitution and By-Laws.—The proposed amendment to our constitution to conform to an Act 190 of the Legislature of Louisiana, a copy of which was mailed to each member, was acted upon and is recommended to the Society for adoption. This is as follows:

You are hereby notified that at the hour of eleven o'clock on the twelfth day of May, 1925, at Roosevelt Hotel in the City of New Orleans, during the regular annual meeting of the regular members of The American Oil Chemists' Society, a vote shall be

taken for the purpose of adopting or rejecting a proposed amendment to the charter of the Association, consisting of the addition of a new article to the charter, embodied in certain resolutions, in the words and figures following:

"BE IT RESOLVED, by the regular members of The American Oil Chemists' Society, that the charter of this Association, dated June 6, 1922, be amended in accordance with Act 190 of the Louisiana Legislature of 1924, approved July 15, 1924, so as to add a New Article, reading as follows:

ARTICLE XIII

"Hereafter, anything in the preceding articles of this charter notwithstanding, the annual conventions of The American Oil Chemists' Society shall constitute the annual meetings of this corporation, at which the officers and directors of the Association shall be elected, and any and all by-laws, rules, regulations and resolutions adopted or promulgated by such conventions, shall govern and control the affairs of this corporation, in so far as same are not inconsistent with the Constitution and laws of the State of Louisiana.

"BE IT FURTHER RESOLVED, that Messrs. C. B. Cluff and J. J. Vollertsen are hereby delegated, with full power and authority for and on behalf of this corporation, to appear before any Notary Public in the City of New Orleans, for the purpose of executing a notarial act effecting the foregoing amendment, and to do any and all acts and things necessary and proper, in their judgment, to effectually perfect the legal formalities for completing the said amendment to the charter of this corporation."

A change in the By-Laws affecting the prorating of our annual dues, setting apart a portion thereof as subscription to the official JOURNAL, was passed and is recommended to the society for adoption. The reason for this change is to conform to postal regulations in order to obtain the lowest possible rate for the JOURNAL. Upon passage and certification of these changes we will enjoy this low rate and receive a rebate on postage paid on issues already distributed.

You have heard Secretary-Treasurer Caldwell's decision in regard to his office, which he has so creditably filled for several years. Upon announcement of his decision to the Governing Committee, it was thought a proper time to bring up a question which has been discussed for some time. The Committee recommends to the Society the following changes in the By-Laws:

Article III of the By-Laws shall be amended by adding at the end thereof the following:

Section (e)

The President and three Vice-Presidents shall be elected at each annual meeting by a majority vote of all members present. The Secretary-Treasurer shall be elected in the same manner upon nomination by the Governing Committee. The Editor and Managing Editor of the JOURNAL shall be appointed by the Governing Committee and shall serve under their direction.

Article IV—Section (*a*) of the By-Laws shall be amended so as to read as follows:

Section (a)

The Governing Committee shall consist of the President, three Vice-Presidents, and the four most recent ex-Presidents of the Society. The eldest ex-President in point of service shall be automatically dropped from the committee each year, and his place taken by the retiring President. The Governing Committee shall be the general executive body of the Society.

It was ordered that the incoming President of this society make application and consummate plans for this Society to become an associated society of the American Association for Advancement of Science.

It was ordered that the incoming President appoint a committee to take up the matter of printing the methods of this Society, but with the understanding that these shall not cause any expense to the Society. This is based upon a tentative offer by Lefax, Inc.

The committee also by letter ballot some time ago authorized the purchase of a set of Lovibond color glasses used by Mr. Bailey in standardizing colorimeters and to be standardized by the Bureau of Standards. This set of glasses to be used to standardize member's sets under rules to be adopted hereafter.

THE PROCTER & GAMBLE CO.
IVORYDALE, OHIO

MINUTES OF THE SIXTEENTH ANNUAL MEETING

New Orleans, La., May 11, 1925

BY THOS. B. CALDWELL, *Secy.*

1. Convention called to order by President Morrison.
2. Invocation.
3. Reading of minutes of last meeting, on motion, was omitted.
4. With Vice-President Vollertsen presiding, President Morrison delivered his annual report as President. On motion, this was referred to a special committee consisting of Messrs. Tilson, Paquin, and Cluff.
5. Report of Secretary-Treasurer, by Thos. B. Caldwell. Referred to Auditing Committee consisting of Messrs. Trevithick, Hamner, and Fash.
6. Report of Governing Committee presented by Chairman Morrison. On motion, report was received and recommendations are to be taken up one by one at the pleasure of the Society.
7. Report of the Referee Board. Read by N. C. Hamner. On motion, this was received and referred to the Governing Committee.
8. Report of Membership Committee, by Chairman Vollertsen. Accepted, with the thanks of the Society.
9. Editor's Report. Published in the April issue of the JOURNAL, but read. Moved that it be accepted and that a telegram be sent Mr. Bailey expressing our regret at his absence and in appreciation of the work that he has done.

10. Report of the Managing Editor, by Fred H. Smith. Report received and Mr. Smith thanked for the splendid work which he has done during the past year.

11. Paper, Dr. C. A. Browne, Chief, Bureau of Chemistry, U. S. Dept. of Agriculture, "Recent Contributions to the Chemistry of the Cotton Plant and Its Products." The Society gave Dr. Browne a unanimous rising vote of thanks for his paper, his presence, and the coöperation of the Bureau of Chemistry.

12. Committee on Detergents. Archibald Campbell. Ordered that report be adopted and work continued.

13. Paper, Dr. Geo. S. Jamieson, "Further Report on the Constituents of Cottonseed Oil."

14. Report of Refining Committee, C. B. Cluff.

25. Report of Uniform Methods Committee, F. B. Porter. Recommends the following: (1) That the rules on sampling cottonseed products recommended by Mr. G. Worthen Agee, page 52, October number of the *Journal of Oil & Fat Industries* be made official under Rule 240. (2) That the so-called wet method of the analysis of soap stock, page 18 of the July number of the *Journal of Oil & Fat Industries* be made an alternate method under Rule 277, section 2. (3) That the standard methods of the American Chemical Society's Committee on Soaps, Volume **6,** Numbers 10 and 11 of the *Cotton Oil Press* be made official. Rule No. 279 already covers this point with the Interstate Association. (4) That the changes in Rule 272, section 6, covering amount of lye to be used in refining off oil suggested by Mr. Morrison be made official (See October, **1924,** *Journal of Oil & Fat Industries*). (5) That the methods for oil and ammonia recommended by this year's seed analysis committee be adopted as tentative by this Society only and that every member making seed analyses be requested to use this method having in view its recommendation to the Chemists' Committee next year. (6) That the recommendation of this year's refining committee on filtering oil be incorporated in Rule 272, section 7-*a*.

Uniform Methods Committee advises that all of the above recommendations which affect changes in the Interstate Rules were passed upon favorably by the Interstate's Chemists' Committee and will be recommended to the Interstate Rules Committee.

This report was adopted by the Society.

15. Appointment of Special Committees and Miscellaneous Business. The following were appointed as Resolutions Committee: Messrs. Barrow, Tilson, and Aspegren. Nominating Committee: Irwin, Cluff, and Paquin.

17. Paper, E. E. Randolph, "Engineering College Courses in Vegetable Oils." The Society thanked Dr. Randolph for this paper.

This concluded the business of the first day.

May 12, 1925

24. Meeting called to order by President Morrison.

16. Bleach Test and Fuller's Earth Committee Report. Chairman Putland's report was read by someone else in Mr. Putland's absence. On motion the report was received and referred to the succeeding committee for further study.

18. Report of Spent Fuller's Earth Committee. No report.

22. Report of Coöperative and Basic Research Committee. E. R. Barrow. Report received and vote of thanks given the Committee for its work.

23. Report of Committee on Standardization of Lovibond Colorimeter. H. P. Trevithick. Ordered that report be accepted and that the next committee include in their next report some definite specifications for adoption.

28. Paper, N. F. Harriman, "Coöperative Work of the Bureau of Standards."

19. Paper, Geo. S. Jamieson, "A Preliminary Report on the Keeping Quality of Crude Oils."

26. Report of the Planning Committee. In the absence of Chairman Wesson, Mr. Morrison reported progress.

At this time the proposed amendment to the Charter, Article XIII, was considered, and adopted. Notice of this proposed amendment was sent out prior to the meeting to the entire voting membership.

The proposed amendments to the By-Laws were also adopted.

Amendments to Article III, Section (*e*), and Article IV, Section (*a*), were also adopted.

29. Report of Committee on Sampling and Analysis of Commercial Fats and Oils. In absence of Chairman W. D. Richardson, the report was read by W. H. Irwin. The following members have been added to this committee: Law, Long, and Trevithick. Report to be published later.

30. Paper, Wm. C. Powick. (Mr. Powick was not present and report was read by Dr. Jamieson.) "Studies on Rancidity. The Characteristics of Rancid Fats as Food." This paper will be published in the *Journal of Agricultural Research*, which see and abstract. Moved that the Secretary write Dr. Powick and thank him for the paper.

27. Report of Ammonia Committee, H. C. Moore, Chairman. In Mr. Moore's absence, the report was read by Dr. Battle.

32. Report of Moisture Committee, by Mr. P. S. Tilson. Ordered that this report be received and that the Committee be continued and study proposed method. Also that at least one check meal sample be reported each month using this proposed method.

33. Report of Committee on Seed Analysis, John Malowan. Report received with the thanks of the Society.

20. Associate members given opportunity of expressing themselves, but none took advantage of the opportunity.

34. General Business. A vote of thanks was given to Messrs. H. C. Moore, R. F. Montsalvatge, and C. A. Butt of the Ammonia Committee for their work. Also to Miss Louise MacDonald for her valuable assistance.

Report of Auditing Committee. Accepted and ordered spread upon the minutes.

Report on the President's Annual Address. Report adopted.

Report of Resolutions Committee adopted.

Dr. C. A. Browne elected to Honorary Membership in due form.

37. Election of Officers: *President*, J. J. Vollertsen; *1st Vice-President*, R. H. Fash; *2nd Vice-President*, A. W. Putland; *3rd Vice-President*, Thos. B. Caldwell; *Secretary-Treasurer*, J. C. P. Helm.

38. Officers installed.

39. Convention adjourned.

LAW & CO.
WILMINGTON, N. C.

Secretary-Treasurer's Annual Report for 1924–25

FINANCIAL STATEMENT

Receipts

Cash on hand April 30, 1924			$1,422.92
Dues collected 1923–24	1 Active Member	6.00	
1924–25	191 Active Members	1,146.00	
1925–26	10 Active Members	60.00	
1924–25	26 Corporation Members	260.00	
1925–26	1 Corporation Member	10.00	
Sales: Fuller's Earth, 973 pounds		194.60	
Standard Salts, 28 bottles		28.00	
Moisture Dishes, 346		20.76	
Smalley Foundation Receipts		966.00	
JOURNAL receipts from various sources		579.27	
Referee Certificate fees		11.00	
Interest		17.06	
1923–24 accounts collected during the year		26.46	
Old accounts collected, formerly charged off		.35	
			$4,748.42

Disbursements

Smalley Foundation expense	$ 862.20
Office expense	423.85
JOURNAL expense	935.02
Salaries	750.00
Fuller's Earth Expense	55.68
Standard Salts expense	18.34

Color glasses purchased	64.00
Advertising in JOURNAL	10.80
1924 Convention expense	185.50
1925 Convention expense	8.15
Printing	50.50
1924–25 accounts outstanding May 7, 1925	4.80
Cash on hand, May 7, 1925	1,379.58
	$4,748.42

The Society has on hand the following:

Cash	$1,379.58
Liberty Bonds	400.00
Outstanding accounts for 1924–25	4.80
Outstanding accounts over a year old	2.34
Fuller's Earth, approximately, pounds	2300
Standard Salts, bottles	4183
Moisture Dishes	2754
Standard color glasses	32

The outstanding accounts are as follows:

From 1923–24:

Lange Soap Co., San Antonio, Texas	1.15
Magnolia Provision Co., Houston, Texas	.32
Mutual Cotton & Oil Co., Phoenix, Arizona	.87

From 1924–25:

Dallas Oil & Refining Co., Dallas, Texas	4.80

The Membership is as follows:

Active Members, 224; Corporation, 39; Honorary, 4; Total, 267. During the year, we have added as follows: Active, by application, 37; by reinstatement, 1; Corporation, 5; Total, 43. During the same period, we have lost as follows: Active, by resignation, 6; by death, 2; by suspension for non-payment of dues, 34; Corporation, by resignation, 2; by suspension for non-payment of dues, 4; total members lost, 48. Therefore, we have five less members than at our last annual meeting.

Mr. President: Having served the Society for over five years as its Secretary-Treasurer, and on account of the demands now made on me by my business connections, I ask your Nominating Committee not to consider me for re-election.

My association with the officers and members of the Society has been most pleasant and I shall never forget the delightful fellowship and the hearty coöperation of the membership.

In submitting the foregoing report, I ask that an Auditing Committee be appointed to make a thorough audit of the books of the Secretary-Treasurer and report back to the Society before its adjournment on May 12th.

ORIGINAL CONTRIBUTIONS

RECENT CONTRIBUTIONS TO THE CHEMISTRY OF THE COTTON PLANT AND ITS PRODUCTS[1]

By C. A. Browne

The science of chemistry in its investigation of the various crops which are utilized by man has from necessity confined its attention to only very limited portions of the field. A complete chemical history of an individual species of plants has never as yet been written and we are probably safe in saying that it never will be written. Such a history involves a knowledge of every chemical compound in the roots, stalks, leaves, fruits and other organs of the plant; of the manner in which these various compounds are produced; of the chemical processes which underlie all the various physiological activities such as germination, assimilation and growth; of the chemical reactions involved in the relations between the plant and its surrounding, such as soil, water, air, sunlight, insects, bacteria and other externals; and finally of the chemical utilization of the various parts of the plant for the specific needs of commerce and industry. Even the crops which have been most studied, such as corn or wheat, appear to the chemist only in the resemblance of an unsolved, very complicated cross-word puzzle; with here and there a section filled in, with a few suggestive key words perhaps inserted, but with many blank spaces still remaining to be worked out.

In my brief talk to you this morning upon certain features of the research work of the Bureau of Chemistry I am obliged from lack of time to limit myself to the work which some of our chemists in Washington have been conducting upon the cotton plant. This work has been carried out independently in five of our Bureau laboratories each one of whom had been assigned a separate line of investigation and it is the correlation of some of this work that I wish to bring to your notice.

The attention of mankind had been focused so long upon the valuable fibers or seed-hairs of the cotton plant that chemists overlooked for many centuries other numerous possibilities of utilization. This does not mean, however, that nothing remains to be learned at present about the chemistry of the cotton fiber, which as you know has been employed for making cloth, paper, guncotton, celluloid, artificial silk and many other products. Chemistry is discovering every year new uses for the cotton fiber and there seems to be no limit to the number of ways in which it can be utilized. The cotton fiber, as you know, is pure cellulose and, like sugar, belongs to the carbohydrates; all that is needed for its production is water, air and sunshine. In one respect, therefore, it is an ideal agricultural crop for it

[1] Presented before the 16th Annual Convention of the Am. Oil Chem. Soc'y, New Orleans, May, 1925.

removes nothing from the soil. If the seed, leaves and other plant residues were completely restored to the soil after each crop there would be no depletion of fertility. In the early days the cottonseed was occasionally returned to the fields as a fertilizer, but more often it was allowed to decay in piles about the gin houses or disposed of by emptying into streams. It was only about 150 years ago when the London Society for the Encouragement of Arts, Manufactures and Commerce, in 1783, offered a prize for the technical utilization of cottonseed for oil and cattle-food production that chemists began to realize that there was more to the chemistry of the cotton plant than that of its seed hairs. Yet progress was slow and nothing of a serious attempt towards utilization began in the United States until after the Civil War, the annual accumulations of refuse seed about the gins constituting up to this time a great nuisance. In 1873 only 2 per cent of the cottonseed crop was utilized for oil and feed production; in 1890 this had increased to 25 per cent and in 1900 to 50 per cent, the progress thereafter being rapid.

In a recent book published by the Chemical Foundation called "Chemistry in Industry" you will find a very interesting chapter by Mr. Thomas C. Law upon "Cotton and Cotton Products" in which he tells the story of how the cotton plant won the World War by means of the four outstanding contributions which it made in the way of food, clothing, shelter and ammunition. Mr. Law gives a list of thirty or more commercial products which chemistry has manufactured from cottonseed oil and which I will therefore omit discussing in order that I may mention first something about the chemical composition of the oil that is removed from the cottonseed by the commercial process of crushing. Cottonseed oil, which has been a subject of investigation for some time at the Bureau of Chemistry, was found by Jamieson and Baughman to have the following composition:

Glycerides of saturated acids	Per cent
Myristic	0.3
Palmitic	20.0
Stearic	2.0
Arachidic	6.0
Glycerides of unsaturated acids	**Per cent**
Oleic	35.2
Linolic	41.7

While these figures indicate the relative percentages of each fatty acid in the form of its glyceride, they do not indicate the percentage of the different simple and compound glycerides in the oil. When we consider that three different fatty acids may be united with one glycerol radical, the number of possible glyceride combinations in such a complex mixture as cottonseed oil is seen to be very high. Chemists have not as yet at-

tempted to resolve this complex of mixed glycerides into its various components and this difficult analytical problem must await the future for its solution. The separation of complex fatty substances such as cottonseed oil into their various component simple and compound glycerides is without doubt the most important analytical question which the oil chemist of the future must consider. Various methods of attack have been proposed, such as the carefully-controlled fractional crystallization of large quantities of fat at different temperatures, the fractional extraction of the glycerides of different solubility by means of suitable solvents and the separation of certain components by methods of esterification. The future must determine which method or combination of methods shall be most suitable for the purpose.

An important fact noted by Jamieson and Baughman is that cottonseed oil, freshly expressed in the dark, has no action upon a photographic plate. If the expressed oil, however, be first exposed to the sunlight, it acquires the property of fogging a photographic plate when the latter is placed a few millimeters above the surface of the oil in a dark room. The phenomenon does not take place in an atmosphere deprived of oxygen or of moisture. As Russell has pointed out, it probably depends upon the formation of traces of hydrogen peroxide, the action of which upon a sensitized plate has long been known. The mechanism, by which this hydrogen peroxide is formed, is not as yet thoroughly understood. As the reaction does not take place with saturated glycerides such as stearin it is in all probability connected with the absorption of atmospheric oxygen at the points of unsaturation, one atom of active oxygen being eliminated for every atom of oxygen absorbed. The atom of active oxygen thus eliminated might then unite with atmospheric moisture to form hydrogen peroxide. This active oxygen is no doubt also a potent factor in the spontaneous decomposition of the fat, which is associated with rancidity, as suggested by me in a recent paper upon the spontaneous decomposition of butter fat. The subject of rancidity, however, is too vast a one to be considered in a general paper of this kind.

There is also found in crude cottonseed oil a variety of nonglyceride constituents which Jamieson and Baughman have separated and analyzed. They make up usually from about 0.5 to 1.5 per cent of the crude oil although oils from damaged seed frequently contain larger quantities. These non-glyceride components consist of proteoses, peptones, resin, pentosans, raffinose, inosite phosphates, lecithin phosphatides as well as a small quantity of xanthophyll. These impurities in the oil were found to have emulsifying and lipolytic properties which are no doubt the explanation of the losses occasioned by the retention of the oil in the soap stock and of the decomposition of the oil into free fatty acids.

Certain ingredients of the cottonseed, which are left behind after the

expression of the oil, have also been subjected to a careful study by the Bureau of Chemistry. One of the peculiarities of cottonseed, which was early noted in connection with its properties as an animal food, was the poisonous action which it sometimes exercised upon farm animals. The explanation of this toxicity remained a mystery for many years until it was finally attributed by Withers and Carruth about ten years ago to an organic chemical substance of the seed which they called gossypol. A large amount of debate has centered about gossypol. Only within the last year certain English investigators have attributed cottonseed meal poisoning not to gossypol but to a dietary deficiency. The problem, however, has been pretty conclusively settled by Schwartze and Alsberg at the Bureau of Chemistry who have confirmed the findings of Withers and Carruth. They found gossypol to be present in every sample of cottonseed examined and in quantities varying from 0.4 to 1.2 per cent of the raw kernels. The variation in gossypol content was fairly regular in that it tended to vary directly with the oil content, although the reason for this relationship is not as yet understood. Schwartze and Alsberg submit the following proofs that cottonseed poisoning is due to gossypol: (1) gossypol when isolated from cottonseed produces the characteristic symptoms of cottonseed poisoning and (2) the toxicity of various raw cottonseed kernels, when fed to rats, corresponded to their gossypol content. Confirmation of this conclusion is also found in the fact that in the Atlantic Coast States, where the gossypol content of cottonseed averages nearly one per cent, cottonseed meal poisoning is more feared than in the Southwestern States, where gossypol occurs in cottonseed in smaller quantities.

The complete detoxification of cottonseed meal either through removal of this gossypol by solvents or through conversion of the gossypol into harmless conversion products by heating or other means, is one of the most important industrial problems which confronts the food chemist today. Cottonseed will then become a most valuable source of protein in the dietary of man and another claim will be established as to the leadership of King Cotton among agricultural crops.

But there is another reason besides that of toxicity which makes it desirable to eliminate the gossypol from cottonseed before employing it as a food for man or beast. Various studies upon the digestibility of the protein in cottonseed meals have given values which are decidedly below those of meat proteins and casein when fed to rats and other animals. On the other hand the isolated cottonseed globulin after purification has been shown to be capable of supporting growth at the normal rate. This seems to suggest that some substance in the cottonseed diminishes the digestibility of its protein. Jones and Waterman, of the Bureau of Chemistry, were accordingly led to test the effect of gossypol upon the digestibility of cottonseed globulin when treated by artificial digestion with preparations

of pepsin and trypsin. The average digestibility of the pure globulin under those conditions was found to be 60 per cent and of the globulin plus one per cent of gossypol only 51 per cent. The depressing effect of the gossypol upon the digestibility of cottonseed proteins is thus clearly indicated.

The function of gossypol in the physiology of the cotton plant is an interesting question upon which to speculate. Poisonous principles are found in the seeds of many plants and they have been supposed by some to act as a means of protection against the attacks of insects and other animals; some natural process of chemical selection, by which cotton plants with seeds of higher gossypol content secure greater immunity against animal enemies, may play a possible part in this connection. Such philosophical inquiries, however, need not detain us. To the practical chemist interested in food technology gossypol is an objectionable cottonseed constituent which it is desirable to eliminate. To the theoretical chemist, interested in purely organic research, gossypol is a substance of phenolic characteristics whose chemical constitution still remains to be determined. A joint attack upon the gossypol problem is now being carried on in America by these two schools and we may look forward with confidence to its ultimate solution.

While the oil has been the ingredient of cottonseed to attract most attention in the past it is probably safe to predict that the interest of chemists in the future will be transferred more and more to the proteins. Jones and Csonka of the Bureau of Chemistry are at present giving considerable attention to the separation and identification of the different proteins of the cottonseed. By extracting with a 10% sodium chloride solution finely-ground cottonseed kernels from which the oil and resins had been previously eliminated by means of benzene, they were able to dissolve over 75 per cent of the total nitrogenous matter. Upon heating this filtered sodium chloride solution at 85°C. they obtained a white flocculent coagulum which after washing and drying was found to contain between five and seven per cent of nitrogen and the unusually high ash content of 68 per cent. This ash upon analysis was found to contain 57.29 per cent of phosphoric acid (P_2O_5), 9.71 per cent of calcium oxide (CaO), 16.62 per cent of magnesium oxide (MgO), and 13.90 per cent of sodium oxide (Na_2O). The identification of this peculiar nitrogenous phosphatic compound, which is perhaps a nucleic acid derivative, is now under way.

The filtrate from the phosphatic coagulum obtained at 85°C. was next treated with ammonium sulfate at 0.23 saturation. The flocculent precipitate thus obtained was filtered off, and, after redissolving and reprecipitating with ammonium sulfate several times, purified by dialysis. The compound thus obtained was designated α-globulin, and it contained 18.22 per cent of nitrogen.

The filtrate from the α-globulin was treated with an additional amount of ammonium sulfate at a final saturation of 0.74, when a second flocculent precipitate settled out which after purification and dialysis was designated β-globulin. This preparation contained 17.77 per cent nitrogen, calculated on an ash-, and moisture-free basis.

The dialysate from the β-globulin was concentrated under reduced pressure and then precipitated with alcohol when a fourth nitrogenous preparation was obtained. This material, calculated on an ash- and moisture-free basis, contained 12.64 per cent of nitrogen and 16.57 per cent of a pentose sugar. The ash content of the air-dried preparation was 4.60 per cent.

Jones and Csonka have determined the distribution of nitrogen, in the proteins which they have isolated from the cottonseed. These and other details of their work will soon be published in a forthcoming paper upon "The Proteins of the Cottonseed."

The examination of the cottonseed meals which are sold in the interstate commerce of the United States has been conducted for many years by the Bureau of Chemistry. A comparison of the analytical data obtained in this work for the cottonseed meals produced in different states over a long period of time has led to some interesting observations. The State of Texas, for example, produces seed of higher protein and less oil content than that of states further east. The complete correlation of these results with climatic conditions, such as rainfall, sunshine and temperature, remains to be worked out.

The cottonseed meal which is sold in interstate commerce has given the Bureau of Chemistry a great deal of trouble in a regulatory way, owing to the fact that mills have failed either to appreciate the importance of delivering meal up to its guaranteed percentage of proteins or to overcome difficulties in manufacture. This has resulted in much low protein meal being placed on the market. Some mills have found it possible to keep their meals up to guarantee, while others think it is impossible. Since the protein content of the finished meal can be lowered to any point the mill desires by the addition of hulls, a great deal of attention has been given to this point by managers of the mills. Of course, the more hulls that are added the more meal there is to sell and the managers of the mills feel that they are giving away value when their meal runs even a few hundredths of a per cent over the guaranteed figure. This has resulted in a large number of cases being brought under the Federal Food and Drugs Act on the charge of low protein. In these days of close business competition manufacturers of every commodity find it necessary to allow themselves the least possible excess in fulfilling their guarantees as to weight or compos tion. But when they permit themselves no leeway of this kind, the carelessness of workmen, the deterioration of product and other con-

tingencies are very apt to bring their commodities below guarantee. The close cutting of guarantees, like that of corners in automobile driving, will sooner or later bring trouble and is never to be recommended.

Leaving now the seeds of the cotton with their wonderful storehouse of interesting chemical substances, we will turn our attention to the leaves, which constitute the laboratory where the raw materials are manufactured that give rise to the cellulose, oil, protein, gossypol and other organic constituents of the plant. The chemical reactions which take place in the leaf of the cotton plant are of such complexity that they are only imperfectly understood. We know in a general way that in the green chlorophyllaceous cells of the leaf, the water which is absorbed through the roots from the soil and the carbon dioxide which is absorbed through the leaf-pores from the air undergo combination under the influence of sunlight with the formation of sugar which is then transplanted to other parts of the plant where it is converted into starch, cellulose, lignin, oil and other nitrogen-free products. We also know that the nitrogen of the soil water (in the form of nitrates and ammonium salts), enters into organic combination with the products of photosynthesis in order to form various amino acids, which are then transported to the seeds and other organs where they are stored up as protein. This formation of the basic components of carbohydrates, oil and protein we may term the primary chemical functions of the leaf; but in the performance of these major activities there take place numerous complicated side reactions of which we can form only a very imperfect picture. Although the substances formed in these side reactions may be insignificant in actual amount yet they can be of vast importance both to the advantage and to the disadvantage of the plant. The essential oils, which make up the perfume of cotton blossoms, exist only in minute quantities yet they are supposed to perform a most useful function in attracting bees, butterflies and other insects that carry the pollen from flower to flower and thus produce the fertilization which is necessary for seed formation. Odorous volatile substances emanating from other portions of the plant may also act injuriously in attracting insects such as the boll-weevil which do serious harm to the plant. This attracting action of a chemical substance for insects, which is called chemotropism, is so powerful that a single cotton plant growing alone in a large field of corn will give off emanations, unweighable in amount, but yet sufficient to attract weevils from a long distance. The determination of some of these odorous volatile compounds, which are given off by the cotton plant, was considered therefore to be a problem well worth the attention of the Bureau of Chemistry, for if the specific chemotropic substance which attracts the boll-weevil can be discovered and if this substance is one which can be made synthetically there will then be offered a possible means of using this compound as a bait to lure the boll-weevil to its own destruction.

The results which have been obtained by Power and Chesnut of the Bureau of Chemistry in their investigation of the odorous constituents of the cotton plant throw much new light upon the complex chemical reactions which take place in the assimilative organs of vegetable life. The first step in this research was the procuring of a sufficient amount of the volatile constituents of the cotton plant for the purposes of separation and identification. As some of these compounds occur in only minute traces, of a few thousandths or ten-thousandths of a per cent, it was necessary to work upon relatively large quantities of fresh plant material. The total weight of leaves, squares, flowers, etc., of the growing cotton plants subjected to steam distillation was 7255 pounds, or over $3^1/_2$ tons. The total amount of original distillate thus obtained was about 1400 gallons which by redistillation in a small copper still was reduced to 78 gallons. This concentrated distillate was then shipped from the Departmental Laboratory at Tallulah, Louisiana, to the Bureau of Chemistry in Washington, where the final processes of separation and identification were carried out. It would be interesting to describe the methods which Dr. Power and Mr. Chesnut employed in this work, but this would consume too much of our time and I can only refer to their paper which is shortly to be published in the *Journal of the American Chemical Society*. I need only state that by various processes of extraction, fractional distillation, and precipitation they were able to isolate no less than fifteen different volatile chemical substances that were removed from the cotton plant by steam distillation. These include the following:

1. Methyl alcohol, CH_3OH, in large amount.
2. Amyl alcohol, C_4H_9OH, in relatively small amount.
3. Acetaldehyde, C_2H_4O.
4. Acetone, CH_3COCH_3.
5. Vanillin, $C_8H_8O_3$, in very small amount.
6. Formic acid, HCOOH.
7. Acetic acid, CH_3COOH.
8. Caproic acid, $C_5H_{11}COOH$.

   (6–8: Combined to a greater or less extent with alcohols to form esters.)
9. An optically inactive dicyclic sesquiterpene, $C_{15}H_{24}$.
10. A new optically active tricyclic sesquiterpene, $C_{15}H_{24}$.
11. A paraffine hydrocarbon, m. p., 62°, which was apparently nearly pure triacontane, $C_{30}H_{62}$.
12. A deep blue oil, which probably contained the highly unsaturated hydrocarbon azulene, $C_{15}H_{18}$.
13. A phenol in very small amount, which was either a derivative of *m*-cresol, or a similar substance.
14. Ammonia, NH_3.
15. Trimethylamine, $N(CH_3)_3$.

Of this complex mixture of alcohols, aldehydes, esters, hydrocarbons, phenols, and ammonia derivatives which are obtained by distillation of the cotton plant there is one of a particularly powerful and penetrating

odor and that is trimethylamine, of which as small a quantity as five ten-millionths of a gram can be distinctly detected by the smell. This substance suggested itself, therefore, as the possible chemotropic agent which attracts the boll-weevil to the cotton plant. It still remained, however, to determine whether trimethylamine, which is obtained by steam distillation of the cotton leaves, is also given off by the plant under natural conditions. This question was answered in the affirmative by Power and Chesnut in two ways; first, by making a chemical examination of the dew gathered from cotton-fields; and, second, by examining the condensed vapor given off by cotton plants when growing under bell-jars. Both dew and condensate were found to contain perceptible amounts of ammonia and trimethylamine.

It had been observed previously by Smith of the Bureau of Chemistry in 1923 that the dew on cotton-leaves was strongly alkaline notwithstanding the fact that the natural juices of the cotton plant have a pronounced acid reaction. An analysis of the dew from cotton leaves, made by Power and Chesnut, indicated the presence not only of the volatile alkalies, ammonia and trimethylamine, but also of a fixed alkali. A consideration of all observations led these investigators to the conclusion that the emanation of ammonia and trimethylamine from the cotton plant is due to their liberation on the surface of the leaves through the action of a fixed alkali carbonate from certain glandular secretions, upon salts of ammonium and salts of some simple organic base such as choline, secreted by other organs of the leaf.

It has been found from preliminary tests by entomologists of the Department of Agriculture that trimethylamine does have an attractive influence upon the boll-weevil, but much more extended experiments must be undertaken before it can be determined whether this substance, either alone or in mixture with other volatile compounds, can be of any practical use in helping to solve the problem of the boll-weevil.

In addition to this study of the odorous volatile constituents of the cotton plant Power and Chesnut are conducting an investigation of the non-volatile organic substances which are removed from cotton leaves by extraction with solvents. A report of this investigation which promises some interesting developments must be postponed, however, to a later date.

Such in brief are a few recent contributions to the chemistry of the cotton plant. The correlation of all that we know concerning it is, however, only a small fragment of what remains to be discovered. I have limited my discussion to a few points only about the chemistry of the seed and leaves of the cotton plant; nothing has been said about the chemistry of its roots. In fact we have very little chemical knowledge about the roots and root processes of our agricultural crops and this is a serious omission. In my opinion some great epoch-making discoveries will be made in this

much-neglected field. One of the greatest triumphs of modern industrial chemistry is the fixation of atmospheric nitrogen, yet, for almost numberless ages, atmospheric nitrogen has been quietly fixed and utilized in the root nodules of the clover, pea, bean and other leguminous plants. We can prove that nitrogen is fixed there but of the chemistry of this unobtrusive underground process we have almost no information.

Future advancement in the knowledge of the cotton plant and of other crops will best be accomplished by the most active kind of scientific cooperation. Chemistry is the basis which underlies the existence of soils and crops and animals. Eliminate the elements and processes of chemistry and nothing material is left. Yet, agricultural research demands not only the aid of chemistry but of physics, biology, physiology, meteorology, bacteriology, geology and many other sciences. The chemist who works alone will accomplish but little, but if he collaborates with other investigators in the exploration of the borderland where chemistry and the other sciences overlap he will make discoveries of lasting benefit and importance.

BUREAU OF CHEMISTRY, U. S. DEPT. AGRIC.
WASHINGTON, D. C.

COÖPERATIVE WORK OF THE BUREAU OF STANDARDS[1]

BY N. F. HARRIMAN

ENGINEER-PHYSICIST, U. S. BUREAU OF STANDARDS

Immediately following the World War the growing demands for highly trained technical men to meet the increasing demand for industrial research, threatened the Bureau of Standards with a depletion of its staff and thereby a curtailment of its research activities. This situation led to the establishment by the Bureau of a Research Associate Plan, whereby a manufacturer or association of manufacturers might place a graduate physicist, chemist or engineer, at the Bureau for a period of one or more years to carry on investigation in some particular line.

This plan has proved valuable, both in the training of additional research specialists by association with the Bureau staff and in maintaining the research output of the Bureau in lines which are of special industrial importance.

The Bureau of Standards coöperates, wherever feasible, with the industries in the development and promotion of higher standards and minimum production waste in the commodities of commerce. In effect, therefore, the research associate plan is a plan for coöperative investigation to such ends. The work undertaken under this plan is such that it would be done by the Bureau alone if its funds were sufficient. The co-

[1] Presented at the 16th Annual Convention of The Am. Oil Chem. Soc'y, New Orleans, May, 1925.

operative method may be, however, somewhat more certain of practical results and these results thereby likely of quicker adoption. Coöperative work is not encouraged except in fields where the Bureau has rather complete equipment and highly specialized personnel to give advice and assistance.

In line with this policy of closer coöperation, a system of research associates has been worked out, and several of the most important industries are maintaining such associates at the bureau for carrying out particular investigations in which they are interested. In nearly every case these research associates are supported not by a single manufacturer but by a group through their trade association; and the results, which are published by the bureau, are available to the public at large. In this way the facilities of the bureau's laboratories and the experience of its scientific staff are made of benefit to the maximum number of people throughout the country, and incidentally men are trained for the industries in research methods... There are at present stationed at the bureau 46 associates, representing 24 industries. A list of these research associates, together with the divisions to which they are assigned, the problems on which they are working, and the industrial associations represented by them, is given below:

It is particularly gratifying to note the closer relations which are growing each year between the bureau and the industries of the country. Not long ago it was a matter of considerable difficulty to obtain the coöperation of industrial groups in the small amount of research work then carried on by the Government. Now problems are presented to us by almost every industry, and their successful solution depends very largely on the degree of coöperation between those presenting the problem and the bureau. The former are the best judges of the commercial aspects of the question and can give invaluable advice on the practicability of suggested processes, while the latter is best qualified to lay the sound foundation of scientific and technical data upon which the solution of such questions depends.

Mr. P. H. Walker and Mr. F. W. Smither, of the Chemistry Division of the Bureau of Standards are members of your detergents committee. They report that this committee is as yet in the formative stage, but they expect to coöperate with your Society in industrial and technical work on fats and oils for uses other than food.

Dr. I. G. Priest of the Bureau has been working on the investigation of the color of cottonseed oil. Because of his absence from his regular duties at the Bureau, the final standardization on a basis for routine testing has been somewhat delayed. However, the work which he has been doing will contribute directly to this standardization for which detailed plans have been made. The complete standardization will be undertaken this summer with the active coöperation of the Munsell Research Laboratory.

RESEARCH ASSOCIATES ASSIGNED TO THE BUREAU OF STANDARDS

Name	Position	Division	Work assigned for	Assigned by
Parkinson, T.	Res. Asso.	I	Radio Fading Phenomena	Henry S. Shaw, Jr.
Coleman, R. L.	Res. Asso.	II	Research Work in Dental Materials	Weinstein Research Laboratory
Poppe, W. A.	Res. Aid	II		
Miller, M. M.	Clerk	II	Secretarial and Clerical Work in Time Section	Horological Institute of America
Campbell, A. J.	Res. Aid	III	Inv. of the Fire Resistance of Hollow Tile	Hollow Tile Association
Foster, H. D.	Res. Asso.	III		
Eisinger, J. O.	Res. Asst.	III		
Sligh, T. S., Jr.	Res. Asso.	III	Coöperative Fuel Research	Society of Automotive Engineers
Thorne, Mrs. M. E.	Res. Asso.	III		
Weikert, D. L.	Res. Asst.	III		
Peterson, C. A.	Res. Asso.	III	Research in Line of Heat Transmission	Armstrong Cork & Insulation Co.
Krehbiel, J. F.	Res. Asso.	III	Standardization of Pyrometric Cones	Edward Orton, Jr., of Stan-Pyrometric Cone Co.
Fabritz, A. C.	Res. Mech.	IV	Research Mechanics	Munsell Color Co.
Munsell, A. E. O.	Res. Asso.	IV	Colorimetry	Munsell Color Co.
Curtiss, L. F.	Res. Asso.	IV	Research in Radium	National Research Council
Ellitt, A.	Res. Asso.	IV	Research in Optics	National Research Council
Berlin, H.	Res. Asso.	IV	Carbohydrates	Corn Products Refining Co.
LaPorte, O.	Res. Fellow	IV	Spectroscopy	International Education Board
Kunz, A.	Res. Asst.	IV	Carbohydrates	International Education Board
Swanger, W. H.	Res. Asso.	V	Study of Chemical Composition of Gold Alloys for Dental Purposes	Weinstein Research Laboratories
Winkler, J. H.	Res. Asso.	V	Study of Problems in Nickel Electrotyping	The International Asso. of Electrotypers
Hunter, R. B.	Res. Asso.	VI	Inv. of Walkway Materials Measurement of Coefficients of Frictions, etc.	National Safe Walkway Surfaces Code of the Am. Engineering Standards Committee
Chrisler, V. L.	Res. Asso.	VI	Res. Work in Measuring Sound Transmission	Lime and Gypsum Industry
Dutton, H. H.	Res. Asso.	VII	Research in Lime Stones	Indiana Lime Stone Association
Faling, Mrs. M. F.	Res. Asst.	VII	Cleaning and Dyeing of Textiles	National Association of Dyers and Cleaners
Hubbard, C. C.	Res. Asso.	VII		
Gottschalk, V. H.	Res. Asso.	VII	Investigation of Coating of Paper	Bureau of Efficiency
Hamlin, C. H.	Res. Asso.	VII	Standardization of Underwear	Asso. Knit Underwear Mfg. of America
Schurecht, H. G.	Sr. Fellow	VII	Architectural Terra Cotta	National Terra Cotta Society
Fuller, D. H.	Res. Asso.	IX	Terra Cotta Research	National Terra Cotta Society
Kessler, D. W.	Res. Asso.	VII	Planning and Conducting Research on Interior Marble, Designing Apparatus	National Marble Mfg. and Dealers Association
Miller, E. A.	Res. Asso.	VII	Research Work in Lime	National Lime Association
Peter, J. P. C.	Res. Asst.	VII	Research Work in Gypsum	Gypsum Industry of Chicago
Palmer, L. A.	Res. Asso.	IX	Prevention of Efflorescence on Brick Walls	American Face Brick Association
Schenke, E. M.	Res. Asso.	VII	Hosiery and Underwear Research	National Association Hosiery and Underwear Mfrs.
Ashton, F. W.	Res. Asso.	VII	Constitution of Cement	
Bogue, R. H.	Res. Director	VII	Research Work in Cement	
Brownmiller, L. T.	Res. Asst.	VII	Inv. on Properties of Portland Cement	
Dillon, Mary M.	Res. Clerk	VII	Stenographer for Dr. Bogue	Portland Cement Association
Hansen, W. C.	Res. Asso.	VII	Research Work in Cement	
Lerch, William	Res. Asso.	VII	Research on Cement	
Morris, R. J.	Res. Asso.	VII	Osnabury and Jute Cement Bags	
Grenell, L. H.	Met. Engr.	VIII	Preparation and Study of Silver Alloys	Bureau of Mines
Kjerrman, B.	Res. Fellow	VIII	Studying Engineering-Fellowship	The Academy of Science for Engrs., Stockholm, Sweden
Cain, J. R.	Res. Asso.	VIII	Metallurgical Research	American Rolling Mill Co., Metal & Thermit Co., and Trent Process Corporation
Nagy, S.	Inst. Maker	Shop	Instrument Making for Gas Section	American Gas Association

Very extensive data on the spectral transmission of the glasses have already been obtained on the red, yellow and blue glasses for each unit number, from 1 to 20 inclusive.

The objective of his investigations is to put the testing and certification of the glasses on a permanent, secure, and intelligible basis. The equivalent of the various glasses in *dominant wave-length*, *purity* and *transmission* will be established under standard conditions. After that has been done, routine testing can be done in a definite manner.

During the past years the Bureau has accumulated considerable data on the spectral transmission of vegetable oils, including the oils of cottonseed, soya bean, peanut and sesame. Recent approximate analysis of these data indicate that the color variations in the group of vegetable oils studied is due to the variations in concentration of at most four or five different coloring matters: moreover, the data provide an indication as to the exact identity of four of the substances.

Steps have been taken to secure these known coloring matters in pure form, in order that their absorption curves when separately dissolved in the oil base, may be determined. It is then hoped to show definitely the identity and relative amounts of the different coloring matters present in the various oils.

The use of standards enters into almost every activity of the Government, as it does into every industry and into the everyday life of all persons. The work done for the Government is in no wise different from that carried on for Industrial Groups and involves the same problems.

Many bureaus of the Government service are charged with the administration of laws and the establishment of regulations, the intelligent application of which depends very largely on the use of exact standards. This is true to a greater extent than is generally supposed. The Bureau of Standards has coöperated freely with these branches of the Government, and the service rendered has involved every department of physics and chemistry covered by the Bureau's activities. The neglect of such matters in the past has been a frequent source of misunderstanding and litigation between the Government service and the public. Conspicuous examples of bureaus to which assistance has been given are the Customs and Internal Revenue Services, Steamboat Inspection and Coast Guard Services, and the Bureau of Navigation of the Department of Commerce, as well as all bureaus of the War and Navy Departments engaged in construction or development work.

The engineering and building construction in progress at all times by the Government is exceedingly great, both in variety and magnitude. In all of it a knowledge of the materials employed is of fundamental importance from the standpoints of economy, efficiency, and safety. The work of investigating the properties of structural materials was taken up

and is carried on primarily for the purpose of securing the information needed by the Government service in its structural work. This information is necessary to the public in construction work, and every effort is made by the bureau to render its findings available to the public generally. The demands for information of this sort have come from practically all Government bureaus and establishments, but especially in connection with the structural work carried on by the office of the Supervising Architect, the engineering branches of the Army, the Bureau of Construction and Repair of the Navy, the Panama Canal, and the Reclamation Service.

The Bureau of Standards serves as a testing bureau for the various departments of the Government when called upon; and, as such, is assisting to place Government purchases upon an economical and business-like basis. The example of the Government in such matters has a far greater influence upon the public than is generally supposed. The Government can do no greater service to the country than to place its own purchases upon a basis which may be taken as a standard by the public at large. This work involves the specification of a wide range of structural and miscellaneous materials and their testing, when delivered, to ascertain whether or not they comply with the specifications. This is especially important, since such materials are purchased by means of competitive bids, a method resulting in much fraud and injustice unless suitable standards are established and successful bidders held absolutely to this standard in making deliveries. Furthermore, most purchasing officers are realizing the great importance of having such testing done by a disinterested institution equipped with the scientific and other facilities for performing the service in a manner that is fair to both parties concerned in the purchases.

Among the Government bureaus and establishments which have utilized the Bureau of Standards as a testing institution in connection with the purchase of supplies may be mentioned the Government Printing Office, in connection with the purchase of paper, inks, and printing supplies, and the Post Office Department, in connection with the purchase of paper, twine, textiles, etc. A wide range of materials has been tested for the Quartermaster Corps of the Army, the Bureau of Supplies and Accounts of the Navy, and the Panama Canal. The General Supply Committee has called upon the bureau for assistance in the specification of all sorts of supplies and equipment, as well as the testing of samples submitted by bidders of the supplies bid upon. Practically every branch of the Government service, including the District of Columbia, utilizes the Bureau of Standards as a testing bureau. Here, again, as in other fields of the bureau's activities, it gains much useful knowledge, which is given to the public in the form of suitable publications.

In a similar manner, the Bureau collaborates with the Federal Specifica-

tions Board, in the establishment of suitable purchase standards for the use of the Federal Government.

The Bureau experts are members of nearly all of our seventy technical committees; and the chairmanship of twenty-seven of these committees is held by Bureau experts.

These specifications for Government use are adopted only after careful consideration of all pertinent commercial specifications, as it is realized that the selection of a specification or standard without due regard to the manufacturing problems involved would be as serious as for manufacturers to establish them without a careful consideration of the needs of the purchaser. In the selection of specifications for Government use the Federal Specifications Board is coördinating these two interests in a manner which is fair to and understood by both the manufacturer and the user, and will in time base all Government purchases on correct standards of quality and practice. This procedure will, no doubt, serve in time as a model to be followed by large corporations, municipalities, States and the public. In fact, several such cases have already occurred.

In case your society or any group of manufacturers associated therewith, has any problems to the solution of which the Bureau of Standards might be able to contribute, we earnestly invite your attention to the advantages of establishing a research associate at the Bureau.

U. S. BUREAU OF STANDARDS
WASHINGTON, D. C.

CONSTITUENTS OF CRUDE COTTONSEED OIL*

BY GEORGE S. JAMIESON AND WALTER F. BAUGHMAN

This paper reports further progress in the investigation assigned to the Oil, Fat, and Wax Laboratory at the conference of the Basic Research-Committee and the Department of Agriculture, September, 1921.[1]

The authors endeavored to obtain more definite information in regard to the presence of the so-called vegetable mucilage in crude cottonseed oil. For convenience, the "settlings," which separates when the crude oil is permitted to stand several weeks after expression, was examined. The "settlings" from a 5-gallon sample of crude oil was repeatedly extracted with acetone. The insoluble portion of the "settlings" was ground to a powder after the removal of the acetone, and about 125 g. was boiled with 250 cc. of absolute alcohol for several hours in a flask connected with a return condenser. This treatment was repeated with two more 250-cc.

* Presented at the 16th Annual Convention of The Am. Oil Chem. Soc'y, New Orleans, May, 1925.

[1] Previous reports: *The Cotton Oil Press*, **6** (No. 4), 33; **7** (No. 2), 35; **7** (No. 5), 29; THIS JOURNAL, **1**, 30.

portions of alcohol. Then the insoluble residue was transferred to a Büchner funnel, thoroughly washed with alcohol, and air dried. It was found that the alcohol dissolved about 34% of the acetone-insoluble settlings. An experiment made several years ago with the acetone-insoluble "settlings" from another sample of crude cottonseed oil gave about 31% of alcohol-soluble constituents.

The alcohol-insoluble portion of the "settlings" was placed in several paper extraction thimbles and extracted with boiling water in order to remove the mucilage. After about an hour the extraction stopped, owing to the clogging of the pores of the thimbles. Consequently a quantitative determination of the water-soluble substances could not be made. Other procedures, which had been tried previously, were even less satisfactory.[2] The aqueous extract was neutral in reaction. A 20% solution of normal lead acetate was added in excess, and the slightly colored lead salt which separated was filtered and thoroughly washed with water. The filtrate was reserved for examination. The lead salt was suspended in water and decomposed with hydrogen sulfide. After removing the lead sulfide, the filtrate was concentrated to a volume of about 10 cc. on the steam bath and cooled to room temperature. Upon adding 30 cc. of alcohol to this solution, a white gelatinous precipitate of the mucilage was obtained. Qualitative tests showed that it contained small quantities of calcium, magnesium, and phosphorus. When a small quantity of it was added to refined cottonseed oil and the mixture stirred with water, an emulsion was readily formed, which showed no evidence of breaking after being kept for 2 days. It is evident that this substance, which causes emulsions so easily, is a factor in the retention of neutral oil in the soap stock obtained in refining the crude oil. Even if a crude oil is held until the "settlings" has separated before it is refined, it will still contain a considerable quantity of unprecipitated "settlings," the larger part of which can be precipitated by agitating and heating the oil with 2 or 3% of water. However, no practicable method has yet been devised for removing from the oil the substances precipitated by treatment with water prior to the caustic soda refining.[3]

Although it has not been possible to determine the quantity of mucilage in a crude cottonseed oil, it is believed that it constitutes only a very small part of the non-glyceride substances present. This is particularly fortunate in view of its emulsifying powers.

Basic lead acetate was added to the filtrate from the lead salt of the mucilage. No precipitate was formed, which shows the absence of water-soluble gum in the "settlings." The lead was removed as sulfide, and the filtrate was concentrated to a small volume. A somewhat thick brown

[2] *The Cotton Oil Press*, **7** (No. 5), 29.

[3] THIS JOURNAL, **1**, 34.

sirup, with an odor resembling that of roast beef, was obtained. It gave very strong tests for calcium, magnesium, and phosphorus after thorough digestion with concentrated nitric acid. This indicates that the water-soluble portion of the "settlings" contains organic phospho-compounds, which are not precipitated by either normal or basic lead acetate.

In order to compare this so-called mucilage with that which might be obtained directly from cottonseed, about 2 pounds of ground decorticated seed was heated to about 75°C. with water for about 2 hours. The mixture, while hot, was pressed in a cloth bag. About 500 cc. of the solution was boiled for a few minutes to precipitate the proteins and filtered. A portion of the filtrate, made very faintly acid with acetic acid and boiled, gave no further precipitation of protein. An excess of a 20% solution of lead acetate was added to the filtrate. The voluminous light-colored lead salt was filtered and thoroughly washed with water, and the lead was removed as sulfide as previously described. After the concentration of the filtrate to about 20 cc., the mucilage was precipitated by the addition of 80 cc. of 95% alcohol. This voluminous white precipitate was filtered and repeatedly washed with alcohol. Like the corresponding precipitate obtained from the "settlings," it contained small quantities of calcium, magnesium and phosphorus. When a small quantity was stirred with refined cottonseed oil and water, a very persistent emulsion quickly formed. The mucilage obtained from the settlings appears to be identical with that obtained directly from the cottonseed.

The acetone extract of the "settlings" was concentrated by distillation until the larger part of the solvent was removed; it was then allowed to stand for about 2 weeks at room temperature. A crystalline substance, which had separated from the solution, was removed and recrystallized twice from alcohol. About 2 g. of the purified product, which melted at 69° to 70°C. and proved to be stearic acid, was obtained. Stearic acid was also obtained from a concentrated alcoholic extract of the oil separated from the "settlings" which had stood for some weeks. Further concentration of this alcoholic solution gave a small quantity of palmitic acid. This is further proof that the free fatty acids in oils contain saturated acids[4] in addition to unsaturated acids.

It was suggested that a study of the substances which color cottonseed oil be included in the investigation. Part of the color of the crude oil is due to resin,[5] which is removed from the oil when it is refined by caustic soda. It was formerly believed that gossypol, which, if present in any quantity, would naturally contribute greatly to the color of the oil, gave crude oil its red color. Repeated examination of commercial crude oils, however, has shown that they contain no gossypol.

[4] *The Cotton Oil Press*, **7** (No. 2), 35.
[5] *The Cotton Oil Press*, **7** (No. 5), 29.

So far as can be ascertained, there is no method whereby any of the so-called pigments, such as carotin, can be separated from an oil in a form which will serve for their subsequent identification. Apparently the only practical line of attack is by means of the spectrophotometer. As is generally known, Dr. Priest has obtained some definite results in connection with the measurement of the color of oils and the identification of some of the pigments. Therefore, this phase of the investigation belongs more properly to the physicist than to the chemist.

Refining the oil with caustic soda is the only known method for removing all the resin from the oil. No procedure for the separation of the saponified resin from the soap stock has been found, however. Experiments have shown that a portion of the resin separates with the "settlings" when the oil is permitted to stand for a few weeks after expression. Agitating and heating the oil after the removal of the "settlings" with 2 or 3% of water gives a further separation of rosin with other substances. The extraction of the oil which has been treated with water by alcohol will remove more of the resin. The water and alcohol treatments lighten the color of the oil believed to be due to the removal of resin, although it is still red. The resin separated from an alcoholic extract of the oil or the "settlings" is a dark red brown.

A small portion of the resin was dissolved in 50 cc. of warm alcohol. The solution was cooled in an ice bath for an hour with frequent agitation, then filtered to remove a minute quantity of insoluble matter. A small quantity of the solution was tested with an alcoholic solution of cadmium chloride for lecithin, etc., but no precipitate formed. Another portion, to which 10 volumes of acetone was added, also gave no precipitate. An alcoholic solution of copper acetate was added in slight excess to the remainder of the alcoholic solution of the resin. A dark yellow flocculent precipitate separated. This was removed by filtration and thoroughly washed with alcohol and ether. The filtrate, which had been kept separate from the washings, was light yellow, while the original solution of the resin was strongly reddish yellow. The filtrate was heated to boiling, and another small quantity of the copper resinate was obtained. The filtrate was evaporated to dryness. In addition to the resin not precipitated as the copper salt, a considerable quantity of phospho-organic substances, which were not precipitated from the alcoholic solution by cadmium chloride, copper acetate, or a large quantity of acetone, remained in the residue. An analysis of the copper salt dried for several days in an evacuated desiccator showed that it contained 18.4% of copper. The copper salt of the resin from another sample of oil contained 16.7% of copper. It has been found that after the precipitation of the phosphatides by cadmium chloride from the concentrated alcoholic extract of the crude oil a part of the resin can be precipitated by copper acetate. If

copper salts of the free fatty acids separate (by adding too much copper acetate solution) with the copper resinate, as indicated by their strong green color, they can usually be removed from the resinate by repeated treatment with ether.

Examination showed that several preparations of these copper salts contained small quantities of calcium, magnesium, and organic phosphorus compounds. In view of the fact that each preparation of the copper resinate had been thoroughly washed with alcohol and ether, it seems probable that a small quantity of an insoluble copper salt of some phosphatide had precipitated with the copper resinate.

Summary

A small quantity of so-called vegetable mucilage was separated from crude cottonseed oil. It was precipitated from an aqueous solution by normal lead acetate. No water-soluble gum could be detected. Experiments showed that this mucilage readily emulsifies the oil with water and that the emulsion does not break after standing for several days. It is believed that the mucilage constitutes only a very small part of the non-glyceride substances present in the oil.

Treating the oil with water and then extracting the separated oil repeatedly with large volumes of alcohol only removes part of the resin. The resin is partially removed from an alcoholic solution by an alcoholic solution of copper acetate in the form of a dark yellow flocculent precipitate. The copper salt is insoluble in alcohol and ether. It is believed that part of the deep red color of the crude oil is due to this resin.

A Contribution from the Oil, Fat and Wax Laboratory
Bureau of Chemistry, U. S. Department of Agriculture
Washington, D. C.